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circumf., *M* a particle of water on the earth's surface, and *S* the sun. The entire earth being rigid, each part of it will move under the influence of the sun's attraction as if the whole were concentrated at its centre. But the attraction of the sun upon the particle *M*, being different from its mean attraction on the earth, will tend to make it move differently from the earth. The force which causes this difference of motion, as already explained, will be represented by the line *MA*. It is true that this same disturbing force is acting on that portion of the solid earth at *M* as well as upon the water. But the earth cannot yield on account of its rigidity; the water therefore tends to flow along the earth's surface from *M* towards *N*. There is therefore a residual force tending to make the water higher at *N* than at *M*." Now, is it not evident that the inertia of the water has already been overcome, before it reaches the point *N*? Its increased motion has commenced even before it reaches the point *M*, and this velocity is continually becoming more rapid until it has reached its maximum at *N*, and by virtue of its inertia it does not *resist* motion but *continues* moving in a line tang't to the earth at *N*, and thus causes the tide wave 2 or 3 hours after merid'n.

I have made reference to the solar tide only. The lunar tide is produced in the same way, the attracting power being the moon.

PROOF OF A PROPOSITION IN SOLID GEOMETRY.

BY PROF. E. W. HYDE, UNIVERSITY OF CINCINNATI.

It is probable that the prop sition given below has been previously stated. I do not remember, however, to have seen it, and it may be of interest to some of the readers of the ANALYST.

If two different surfaces of the same order are tangent to each other at every point in which they are pierced by a given right line, then the surfaces intersect each other in two *plane curves*, real or imaginary.

Let $V = 0$ and $W = 0$ be two planes passing through the given line, and let $U_1 = 0$, $U_2 = 0$, $U_3 = 0$ etc., be any surfaces whatever. Also let $\varphi(U_1, U_2 \text{ etc.})$ be any rational integral function of U_1, U_2 etc. Then the equations

$$\varphi(U_1,\ U_2 \text{ etc.}) + \lambda_1 V^2 + \mu_1 W^2 = 0, \qquad (1)$$

$$\varphi(U_1,\ U_2 \text{ etc.}) + \lambda_2 V^2 + \mu_2 W^2 = 0, \qquad (2)$$

represent two different surfaces each of which is tangent to $\varphi = 0$ at every point where it is pierced by the intersection of V and W; for (1) and (2) are each satisfied by such values of x, y, z as make φ, V and W simultaneously equal to zero; also, V and W being squared, the given line is the intersection of two pairs of coincident planes, i. e., it is a quadruple line, and the points where it pierces φ are quadruple points common to the surfaces (1) and (2). If we subtract (2) from (1) the resulting equation will be that of some surface passing through the intersection of (1) and (2). Thus we have

$$(\lambda_1-\lambda_2)V^2+(\mu_1-\mu_2)W^2=0,$$

or

$$V\surd(\lambda_1-\lambda_2)=\pm W\surd(\mu_3-\mu_1). \tag{3}$$

Equation (3) represents two real or imaginary planes, according to the signs and relative values of λ_1, λ_2 and μ_1, μ_2. But these planes contain the intersection of (1) and (2), which consists therefore of two plane curves, real or imaginary. Q. E. D.

The particular case of this proposition when $\varphi(U_1, U_2 \text{ etc.}) = U_1 U_2$, and U_1 and U_2 are of the 1st degree, or, in general, when φ is of the 2nd degree, proves directly the property at which I arrived indirectly in an article published in the ANALYST for July, 1876; viz., Two quadrics will intersect each other in plane curves when they have common tangent planes at the extremities of a common chord.

We may also write the reciprocal proposition to this as follows:

If two surfaces of the same class are tangent to each other at the points of contact of all planes that can be drawn tangent to them through a given right line, then they will have two common circumscribing cones; i. e., every common tangent plane of the two surfaces will pass through one or the other of two fixed points on the given line.

SOLUTION OF A PROBLEM.

BY GEORGE EASTWOOD, SAXONVILLE, MASS.

Problem.—Now that there are three tickets before the people, from which to elect our next President, let it be supposed that the votes will be divided between the candidates, on the assumption that the voters will attribute to the three tickets every degree of merit comprised within the limits 0 and 100. Supposing the voters to find in each ticket some—*more* or *less*—of every degree of merit contained in the other two, it is required to assign the mean value of *all* the the merits of the three tickets.

Solution.—That the question may have the utmost generality, let us suppose the number of tickets to be n, and the limits of their merits to be between 0 and a. Suppose β_1, β_2 . . . . . β_r represent the respective merits of the n tickets, β_1 being the merit attributed to the ticket which the voter